STATE & PRIVATE FORESTRY
FOREST HEALTH PROTECTION
SOUTH SIERRA SHARED SERVICE AREA

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To: Sarah Craighead, Death Valley National Park Superintendent
Kelly Furhmann, Chief of Resource Management

From: State and Private Forestry, Forest Health Protection, South Sierra Shared Service Area

Subject: Piñon Pine Sawfly Activity in Death Valley

On August 23-24, 2010, Beverly M. Bulaon and Martin MacKenzie (Forest Health Protection, South Sierra Shared Service Area, Entomologist and Pathologist) conducted field evaluations of recent defoliation occurring in single leaf piñon pine in various locations in Death Valley National Park. Jane Cipra (Park Botanist) requested FHP assistance to evaluate the extent and severity of the defoliation occurring primarily around Hunter Mountain. This report discusses observations and recommendations for management of piñon sawfly should populations persist.

Introduction

Death Valley National Park is located within Inyo County, composing nearly the entire eastside of the county. While desert conditions prevail most times of the year, ground vegetation and trees are not completely absent in this arid environment. Single-leaf piñon pines (*Pinus monophylla*) cover mountain peaks within the Inyo National Forest, and several mountain ranges within the Park. In the Park, piñon pines were found between 5500 to 7000 feet elevation around mostly sagebrush (*Artemeisa* sp). ground cover. Joshua Trees (*Yucca brevifolia*) and Utah Juniper (*Juniperus osteosperma*.) began appearing at 4000 feet, but sharp delineations between all species were visible as elevation increased. In the mountains along streamsides or natural springs, various willow species (*Salix sp*.) were found. Average rainfall in the higher elevations average between 0-5 inches.

Over 10,000 acres were defoliated by piñon sawfly (*Neodiprion edulicolus*) within Inyo County (see Figure 1, source 2009 Aerial Detection Survey, Forest Health Monitoring Program). The flight was conducted in August/September, marking current year activity. High levels of defoliation (greater than 50% defoliation) were primarily detected around Hunter Mountain in the Park, with low levels occurring along the Inyo Mountains in Inyo Wilderness. Flights over Death Valley were not conducted in 2008.

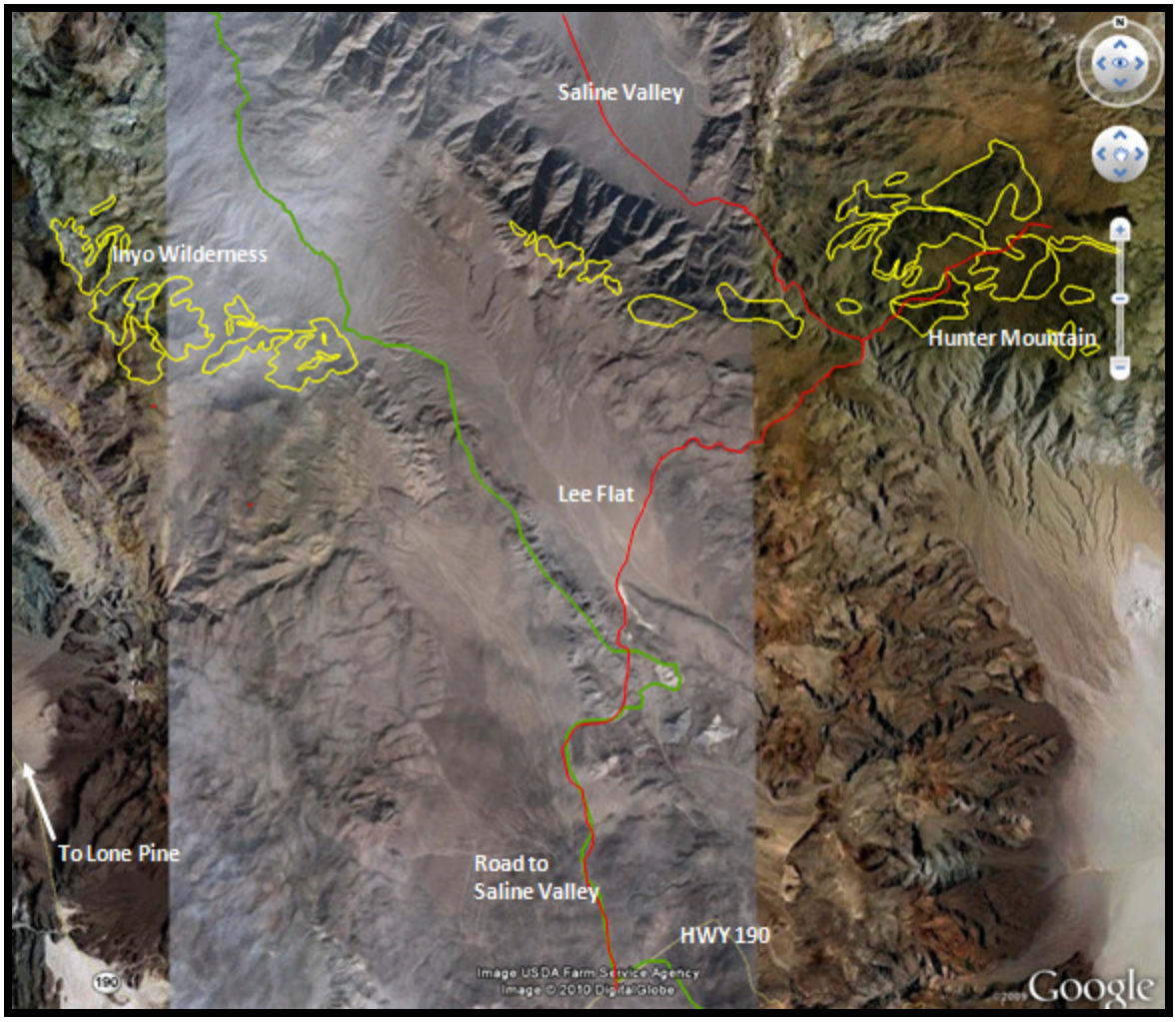


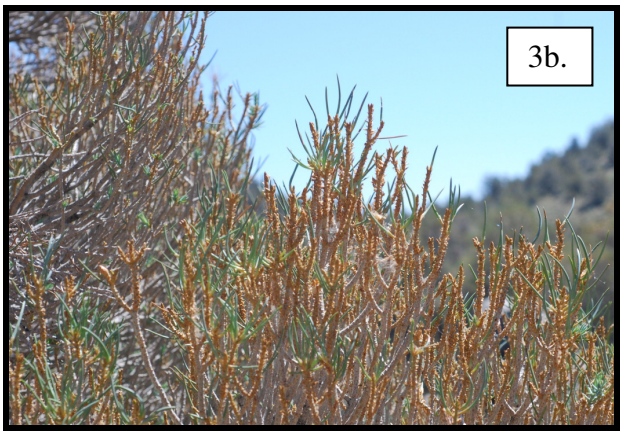
Figure 1. *Forest health Monitoring 2009 aerial surveys of piñon sawfly activity within Death Valley and Inyo National Forest displayed using Google Earth®. More polygons were detected further north west along the Inyo Mountains, not shown in this picture. Moderate to severe defoliation were found primarily around Hunter Mountain.*

Observations

Ground surveys were conducted in early July by Park personnel, and later by FHP (August) of several locations within Hunter Mountain. Park personnel remarked about the high density of sawflies during their surveys: every tree was affected, every branch covered by 5-10 larvae. FHP arrival in mid-August was past larval development, but evidence of defoliation was widespread. Around Hunter Mountain, defoliation stretched from the turnoff at South Pass nearly to Utilda Flat. It is estimated that 80% of the trees around Hunter Mountain were infested, with 50% moderately to severely defoliated (see Figure 2).

Figure 2. Widespread defoliation of piñon pines in Hunter Mountain by Piñon Sawfly.

At a distance, affected trees appeared to be dying, with some tree crowns defoliated near 100% (see Figure 3a). Older needles were completely stripped, leaving shriveled needle stubs that gave trees a red appearance (see Figure 3b). Current year needles and next year buds were not stunted or fed upon (typical sawfly feeding pattern) – even severely damaged trees retained a fair number of needles at the tips (see Figure 3c). Severely affected trees had an abundance of new cones. "Stressed cone crops" are trees' attempts for reproduction before expiration, typically a symptom associated with root disease. However, this crop may have been a normal two-year cycle of production for piñon pines (Burns and Honkala 1990), and it is unknown whether defoliation occurred during 2008 that could have also incited mass cone production.



Figures 3a to 3c: 3a. *Piñon pine with over 90% defoliation; 3b and 3c. Close-up views of remaining current year needles on trees with severe defoliation.*

Figure 4*. New "stress cone crop" on piñon pines severely defoliated by piñon sawfly.*

Other insects were noted during FHP field visit, but injury from these agents was minimal. Trees infested with piñon pitch mass borer (*Dioryctria spp*) were also affected by sawfly. Attacks of this borer were moderate; no additional decline could be visibly noted (see Figure 5a). Piñon Ips (*Ips confusus*) had recently killed a single tree near the Historic Hunter Mountain cabin most likely associated with the chainsaw pruning during site rehabilitation this summer (see Figure 5b); no evidence of recent mortality by piñon ips around Hunter Mountain was observed. Red turpentine beetle (*Dendroctonus valens*) also took advantage of the pruning activity at the cabin to attack bases of a few small trees (see Figure 5c). Tree mortality overall – current or older – was very low and scattered. No symptoms or signs of root diseases, dwarf mistletoes, or other pathogens were found.

Figures 5a through c. *Piñon pitch mass borer activity found on trees also affected by piñon sawfly (top left). Piñon Ips, top right (photo courtesy of Darren Blackford, ForestryImages.org). Red turpentine beetle larvae (under removed bark) at the base of a recently dead tree at Hunter Mountain (bottom).*

Discussion

Biology and population cycles of piñon sawfly are similar to other native defoliating insects. Feeding usually goes undetected until populations are fairly high and defoliation is easily noticeable. Susceptibility to insect attack increase if droughts are protracted or severe. Sawfly populations are known to erupt and decline quickly, natural predators, parasites, and viruses keep populations in check (McGregor 1969) like other native western sawflies (Furniss and Carolin 1977), so outbreaks are typically of short duration. According to Mopper and Whitman (1992), sustained plant stress reduces fecundity and insect performance of sawflies which ultimately contribute to population decline. Slight environmental changes in Death Valley can most likely tip delicate balances within this extreme ecosystem.

Rainfall this past winter was near average for these areas, double of the past three consecutive years. Precipitation was especially high during April when larvae were emerging and beginning to feed. Mopper and Whitman (1992) did find that sawfly performance did increase when watering and fertilizing occurred *concurrent* with larval feeding. They did suggest plants that received some respite (ex: adequate rainfall) after suffering long-term stress (ex: drought) can consequently improve insect performance.

While defoliation from piñon sawfly may look severe, significant mortality due to current levels defoliation is not expected unless dry weather patterns return in the upcoming years. Direct mortality from sawfly is uncommon but can occur in young understory trees that are unable to withstand the severe defoliation compared to mature trees. In addition, smaller trees (no taller than 4 feet) typically have a higher proportion of larvae congregating per needle as they fall from larger trees. Older trees eventually recover if not completely stripped of all needles. New growth may be stunted, but trees typically recover after a few years after sawfly populations collapse.

"No action" approach would result in probable mortality of a percentage of trees, mainly in smaller diameter classes. It is expected that direct mortality from sawfly would be low, but other agents (e.g. piñon ips) may take advantage of severely weakened trees leading to death. Loss of smaller trees will create gaps in stand composition and age diversity. Understory tree mortality may contribute to fuel loading but also provide necessary habitat for wildlife. If populations remain high and persist longer than anticipated, then mortality in larger diameter trees may begin to occur as trees succumb to the repeated loss of foliage.

Management Option: Direct Control

Options for control are available but full assessment of extent and severity of the feeding-caused injury should be strongly considered before planning treatment. Larvae can be physically water-hosed or beaten off of branches for small scale projects or high-value trees. Broad-spectrum chemical insecticides can be highly effective if applied during the larval stage. If insectide applications are warranted, further evaluation would be needed to determine the appropriate treatment method (e.g. aerial versus ground application) and timing. Accurate timing is critical to target the most susceptible life stage.

Forest Health Protection plans to return early next summer 2011 to evaluate larval population levels and survey for mortality. Photopoints have been established in four monitoring plots along Hunter Mountain Road. Piñon sawfly is referenced as far west as Nevada and Arizona (Furniss and Carolin 1977), but has been at very endemic levels in California. It was not seen by aerial detection until 2009, but was recorded from field observations in other locations (California Forest Pest Conditions 2009, 1964). The closest large occurrence of sawfly to Death Valley is Whistler Mountain near Eureka, Nevada (Forest Pest conditions in Nevada 2008). Sawfly appears to be moving westward in Nevada, with small occurrences also detected southwest in the Hot Creek Range. This summer,

populations appear to be static or have slightly decreased but are still dispersing through the state (Gail Durham, Nevada Forest Health Specialist, *personal communication*).

Please contact us with any additional questions or concerns. Our service area is available to provide any additional technical support, competitive financial assistance, management or pest identification training, and NEPA documentation support regarding other forest insect or disease-related issues.

Sincerely,

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